

5 The MTU carousel assembly 671 rotates the MTU 160 to the skewed disk linear mixer 634 where the MTU 160 and its contents are mixed, as described above, at about 14 Hz to facilitate exposure of the target amplicon to the added detection probes. The MTU 160 is then incubated for a period of time sufficient to permit hybridization of the detection probes to the target amplicon.

10 After hybridization incubation, the MTU 160 is again rotated within incubator 606 by the MTU carousel assembly 671 to the pipetting position below the pipette openings 662. A selection reagent stored in a container in the reagent cooling bay 900 is pipetted into each receptacle vessel 162 by the pipette unit 480. A selection reagent is used with the HPA assay and includes an alkaline reagent that specifically hydrolyzes acridinium ester label which is associated with unhybridized probe, destroying or inhibiting its ability to chemiluminesce, while acridinium ester label associated with probe hybridized to target amplicon (or amplicon of the internal standard) is not hydrolyzed and can chemiluminesce in a detectable manner under appropriate detection conditions.

15 Following addition of the selection reagent to each of the receptacle vessels 162 of the MTU 160, the pipette probe 481 of the pipette unit 480 is rinsed with distilled water at the pipette rinse basin 1944. The MTU 160 is rotated by the MTU carousel assembly 671 within the incubator 606 to the skewed disk linear mixer 634 and mixed, as described above, at about 13 Hz to facilitate exposure of the target amplicon to the added selection reagent. The MTU is then incubated in the incubator 606 for a period of time sufficient to complete the selection process.

20 After selection incubation is complete, the left-side transport mechanism 502 transfers the MTU 160 into an available ramp-down station 700 that is accessible to the left-side transport mechanism 502 to cool the MTU 160. After the MTU 160 is cooled, it is retrieved from the ramp-down station by the left-side transport mechanism 502 and is moved by the transport mechanism 502 into the active temperature and pre-read cool-down incubator 602 to stabilize the temperature of the MTU 160 at about 40°C.

25 When a period sufficient to stabilize the temperature of the MTU 160 has passed, the MTU carousel assembly 671 within active temperature and pre-read cool-down incubator 602 rotates to present the MTU 160 at the right-side distributor door of the incubator 602. The right-side distributor door 622 is opened and the MTU 160 is removed from active temperature and pre-read cool-down incubator 602 by right-side transport mechanism 500.

15 The right-side transport mechanism 500 moves the MTU to a bar code scanner (not shown) which scans MTU bar code information posted on the label-receiving surface 175 of the label-receiving structure 174 of the MTU 160. The bar code scanner is preferably attached to an outer wall of the housing of the luminometer 950. A preferred bar code scanner is available from Opticon, Inc., of Orangeburg, New York, as part number LHA1127RR1S-032. The scanner verifies the total time of assay prior to entering the luminometer 950 by confirming the correct MTU at the correct assay time. From the bar code reader, the right-side transport mechanism 500 moves the MTU 160 to the luminometer 950.

10 In a preferred mode of operation, before the right-side transport mechanism 500 moves the MTU 160 into the luminometer 950, the MTU 160 is placed by the right-side transport mechanism 500 into an available MTU ramp-down station, or chiller, to decrease the temperature of the MTU 160 to  $24 \pm 3^{\circ}\text{C}$ . It has been determined that the MTU contents exhibit a more consistent chemiluminescent "light-off" at this cooler temperature.

## 15 LUMINOMETER

20 Referring to FIGURES 40-42C, a first embodiment of the luminometer 950 includes an electronics unit (not shown) within a housing 954. A photomultiplier tube (PMT) 956 linked to the electronics unit extends from within the housing 954 through a PMT plate 955, with the front end of the PMT 956 aligned with an aperture 953. A preferred PMT is available from Hamamatsu Corp. of Bridgewater, New Jersey as model number HC 135. Signal measurements using the preferred PMT are based on the well known photon counter system.

25 The aperture 953 is centered in an aperture box 958 in front of the PMT plate 955. The aperture 953 and aperture box 958 are entirely enclosed by a housing, defined by a floor plate 964, a top plate 966, the PMT plate 955, and a back frame 965 and back plate 967, which prevents stray light from entering the aperture 953 and which is attached to the datum plate 82. An MTU transport path extends through the housing in front of the aperture 953, generally transversely to an optical axis of the aperture. MTUs 160 pass through the luminometer 950 via the MTU transport path. A back rail 991 and a front rail 995 are disposed on opposite sides of the MTU transport path and provide parallel horizontal flanges which support the connecting rib structure 164 of an MTU 160 disposed within the luminometer 950. Revolving doors 960 are supported for rotation within associated door housings 961 disposed on opposite ends of the

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MTU transport path and are turned by door motors 962, which may comprise stepper motors or DC gear motors.

The door housings 961 provide openings through which MTUs 160 can enter and exit the luminometer 950. An MTU 160 enters the luminometer 950 by means of the right-side transport mechanism 500 inserting the MTU 160 through one of the door housings 961. The MTU 160 exits the luminometer under the influence of an MTU transport assembly, various embodiments of which are described below, which moves MTUs through the MTU transport path and eventually out of the luminometer through the other door housing 961.

Revolving doors 960 are generally cylindrical and include a cut-out portion 963. Each revolving door 960 can be rotated between an open position, in which the cut-out portion 963 is generally aligned with the opening of the associated door housing 961, so that an MTU 160 can pass through the opening, and a closed position, in which a side of the revolving door opposite the cut-out portion 963 extends across the opening of the associated door housing 961 so that neither an MTU 160 nor light can pass through the opening. Except when an MTU 160 is entering or exiting the luminometer 950, the revolving doors 960 are preferably in their respective closed positions to prevent stray light from entering the luminometer. Because test results are ascertained by the amount of light detected by the PMT 956, stray light from sources other than the receptacle 160 being sampled can cause erroneous results.

As shown in FIGURES 40-42C, the MTU transport assembly may include an MTU advance motor 972 which drives a lead screw 974 through a timing belt (not shown) or bevel gears (not shown). A screw follower 976 engaged to the lead screw 974 is coupled to an MTU bracket 977 extending away from lead screw 974 to engage the MTU 160. The MTU bracket 977 has a guide flange 978 with an elongated, slightly arcuate guide hole 979 formed therein. A guide rod 980 extends through the luminometer 950 adjacent and parallel to the lead screw 974. Guide rod 980 extends through guide hole 979.

To advance the MTU bracket 977 (from bottom to top in FIGURE 42C), the lead screw 974 turns counter-clockwise, as viewed in FIGURE 42B. Due to system friction, the screw follower 976 and the MTU bracket 977 will also turn counter-clockwise with the lead screw 974 until the guide rod 980 contacts the left-side of the guide hole 979. When guide rod 980 contacts the side of guide hole 979, MTU bracket 977 and screw follower 976 can no longer rotate with lead screw 974, and further rotation of the lead screw 974 will cause the MTU bracket 977 and screw follower 976 to advance along the lead screw 974. Arms 981 extending from the MTU